Section C "About Teaching"

Introduction

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"Teaching" is often considered as the complementary side of "learning" in two directions: in seeing teaching as the cause of learning and in seeing learning as the outcome of teaching. However anyone knows that school teaching is an activity organized by the society and aimed at the transmission of culture to the young generations and that lots of things are learned outside of school through interactions both with the natural world and the social community. On the other side several research studies have shown failures and infelicities in learning outcomes produced by school situations.

Let's focus the role of a teacher in school: s/he is in charge of communicating to the students the aspects of culture related to his/her competences and disciplinary knowledge. The sciences of communication can therefore suggest a model for teaching that can be useful in the didactical practice. A reasonable/plausible model assumes two principal actors: the transmitter of the communication message (the teacher) and the receivers of it (the students). The process of teaching may then be seen as composed of at least two parts. The first one is in charge of the sender of the message while the second is responsibility of the receivers. The transmitter defines the aims of the communication, chooses the arguments, their organization but also the context of their framing, the tools to be used (verbal communication, experiments, ICT tools, recall of everyday experience, … are emblematic examples for the transmission of physical knowledge). The receivers attribute meanings to the transmitted message according to their knowledge, experience, personal memories, beliefs, convictions. More than one possibility may then be envisaged as far as the understanding of the message is concerned: the meanings attributed by the students are in agreement with those of the teacher (which might be called a situation favourable to a "good understanding"); there may be a total gap between the two meanings ("no understanding"); the receivers may think to have understood but they do not recognise a gap in the meanings. Since there is always a transformation of the message by the receivers, the boundary amongst the above three possibilities often are not sharp ones.

The model for teaching takes into account the communication problems, then points out the necessity of a set of shared meanings to avoid gaps and pitfalls.

The title of the Section "About Teaching" is wide enough to encompass different viewpoints and strategies devised in diverse studies.

The first essay "Communication Skills for Teaching" by Anna Maria Pessoa de Carvalho focuses on the skills requested to the teachers in order to help and support their students' learning processes. The communicative approach by Mortimer and Scott is presented firstly, as a tool for analyzing meaning-making interactions. Then, different types of non-verbal discourse in the classroom are discussed, the aim being how to put scientific discourse into practice. That leads to identify communication skills like those related to language and those needed to arouse argumentation. The skills appropriate to transform regular, everyday language into scientific language and to help students familiarise with mathematical

languages are addressed. Some examples of classroom practice support the proposed approach.

The second essay "History of Physics as a Tool for Teaching" by Igal Galili focuses the possibility of using historical considerations to foster the sharing of meanings in the classroom and support the communication of cultural aspects of physics knowledge. The essay develops through an explanation of the reasons for using history of physics as a tool for teaching and discusses the support to such a viewpoint coming from educational research, in particular the cognitive recapitulation or the similarity of physical ideas developed by students with those of scientists of the past. The final part presents the advantages of using history for teaching Physics as a culture. Examples of teaching practice are presented.

The third essay "Disciplinary knowledge from a pedagogical point of view" by Diane Grayson discusses a teaching approach inspired by the theoretical construct of Pedagogical Content Knowledge proposed by Shulman in the mid '80s. This construct, together with the Model of Educational Reconstruction developed by Duit and colleagues in the 90's, calls for the importance, in any teaching process, of a deep reflection on how the content knowledge has to be guided by pedagogical considerations. In order to transform a physics knowledge into a knowledge appropriate for teaching and capable of helping the student to build their own knowledge nets, many competences are needed, from those related to naïve ideas and reasoning to capabilities of implementing diverse learning environments, to familiarity with research-based innovative proposals, to skills in motivating the students' interest. There is now, in the PER community, a general consensus about the need of addressing the role and importance of such a reflection in teacher education programs in order to help pre and in-service teachers to acquire competence in this field. A possible path is to have experience of specific examples of teaching sequences and analyze them critically. In the essay the steps of some teaching sequences on electric circuits are presented to illustrate the special kind of knowledge that teachers should acquire in order to share meanings with their students. We may recall that many PER studies have addressed the teaching and learning of electric circuits with passive elements, given both the many naïve ideas students hold about electricity and the role of such topics in basic Physics courses. Other sequences have been presented in volume 1 in the essay by Duit and Von Rhöneck entitled "Learning and Understanding key concepts of electricity".